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HIGH LATITUDE MEASUREMENTS OF THE TOTAL ELECTRON CONTENT (TEC) --ETC(U)
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A VHF electronic polarimeter for total electron content (TEC) measurements has been in operation at Tromsø Telemetry Station (69°39'N, 18°56'E) in Northern Norway for the period April 1980 to April 1981. The polarimeter has been receiving data from the geostationary satellite SIRIO, which is situated almost due south of Tromsø at 8° elevation.		

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Except for loss of data during periods when the satellite was eclipsed by the Earth's shadow, continuous data coverage was maintained.

Preliminary analysis of the obtained TEC data and similar data deduced from NAVSTAR-GPS measurements reveal acceptable agreement.

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HIGH LATITUDE MEASUREMENTS OF THE TOTAL ELECTRON
CONTENT (TEC) USING THE FARADAY TECHNIQUE AND COM-
PARISONS WITH TEC ESTIMATES FROM NAVSTAR-GPS DATA

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US Army Contract No DAJA 37-80-C-0193

D R A F T
Final Report
April 1980 - April 1981

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June 1981

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1 DATA RECORDING AT TROMSØ

A VHF Electronic Polarimeter for Total Electron Content (TEC) measurements has been in nearly continuous operation at Tromsø Telemetry Station (Position: $69^{\circ} 39' 43''$ N, $18^{\circ} 56' 28''.9$ E) in the period April 1980 - April 1981. In May 1981 the instrument was shipped back to the Air Force Geophysics Laboratory (AFGL) in Massachusetts from where it had been borrowed.

The polarimeter has been receiving data only from the geostationary satellite Sirio which is situated almost due south about 8° above the horizon as seen from Tromsø. Originally mounted on the roof of a low building, the polarimeter has since late May 1980 been located on the ground in an environment of less interference.

The TEC and scintillation raw data from the instrument's chart recorder were reduced at the site and transcribed to Fortran coding sheets that were shipped regularly to AFGL. To resolve and check on the "nm" ambiguity in the TEC values, ionosonde data from Uppsala (located nearly underneath the subionospheric point where the line of sight Tromsø - Sirio cuts the ionosphere) were frequently used.

The continuity of the data was lost a few times, primarily during two approximately one-month periods in September and February when the reception from Sirio was lost for up to 1.5 hours each night around midnight. These reception losses were presumed to be caused by power failure due to eclipsing of the satellite's solar panels by the earth's shadow.

2 DATA ANALYSIS

The main part of the analysis of the polarimeter data is being done at AFGL under the direction of Mr Jack Klobuchar. At the Norwegian Defence Research Establishment (NDRE) we are interested in the data primarily for a comparison with TEC data obtained concurrently at Tromsø by means of a Navstar GPS Y-receiver (ref 1).

In the near future when the analysis of the Tromsø polarimeter data has been completed at AFGL, plans call for writing a joint paper on the combined results from the polarimeter and the Navstar GPS receiver.

As an example we include here some results for the months of June and August 1980, for which Figure 1 shows overplots of polarimeter TEC values against universal time (UT). In the last column of Table 1, these TEC values have been converted to meters by dividing by 6.4×10^{16} for a few dates on which corresponding GPS values are given in the preceding column for a Navstar space vehicle (SV) in the vicinity of the Sirio satellite, as seen from Tromsø.

The agreement is quite acceptable. We note that the polarimeter values are consistently somewhat smaller than the GPS values. This is to be expected, because the polarimeter neglects the contribution of the plasmaspheric electron content. According to Klobuchar et al. (ref 2) this contribution can amount to at most a 1 m delay.

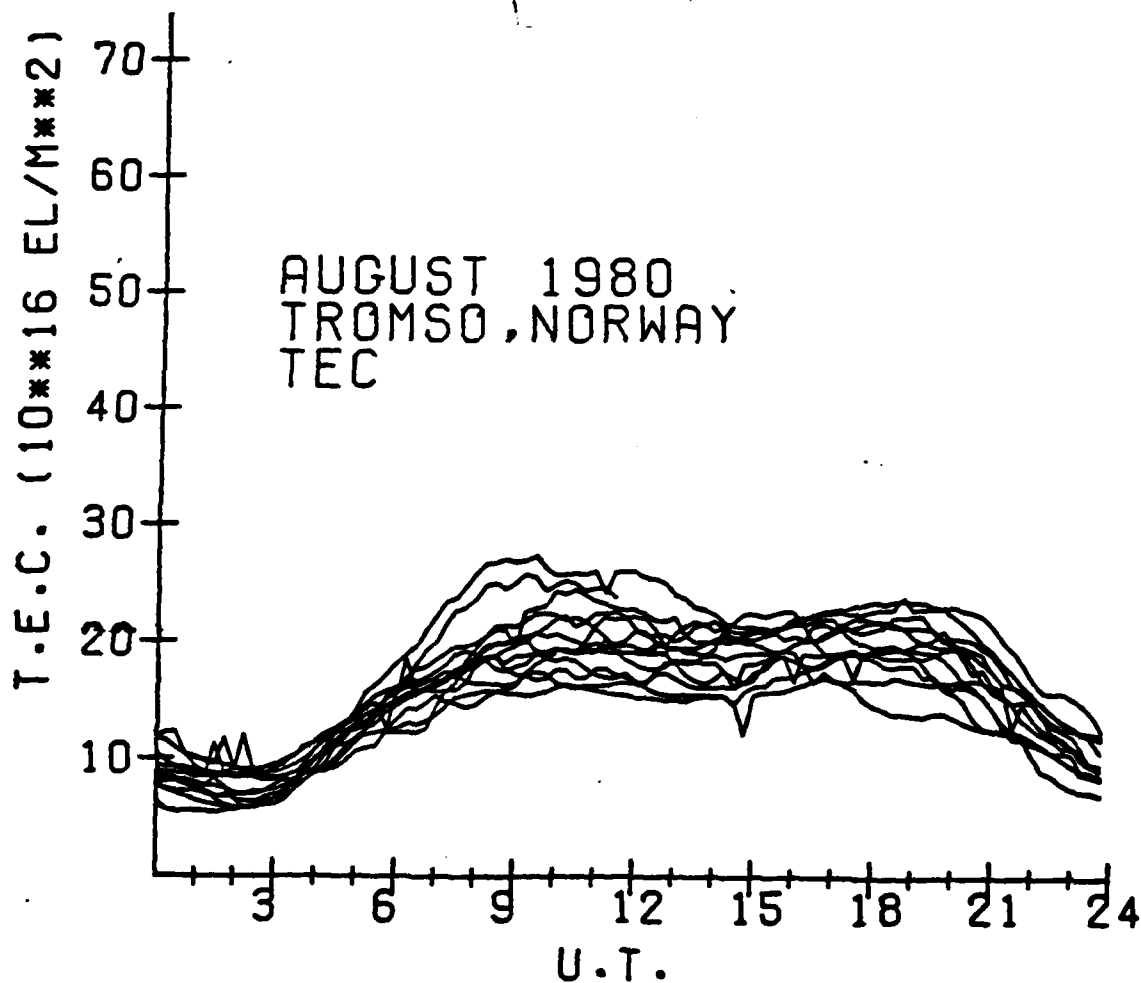
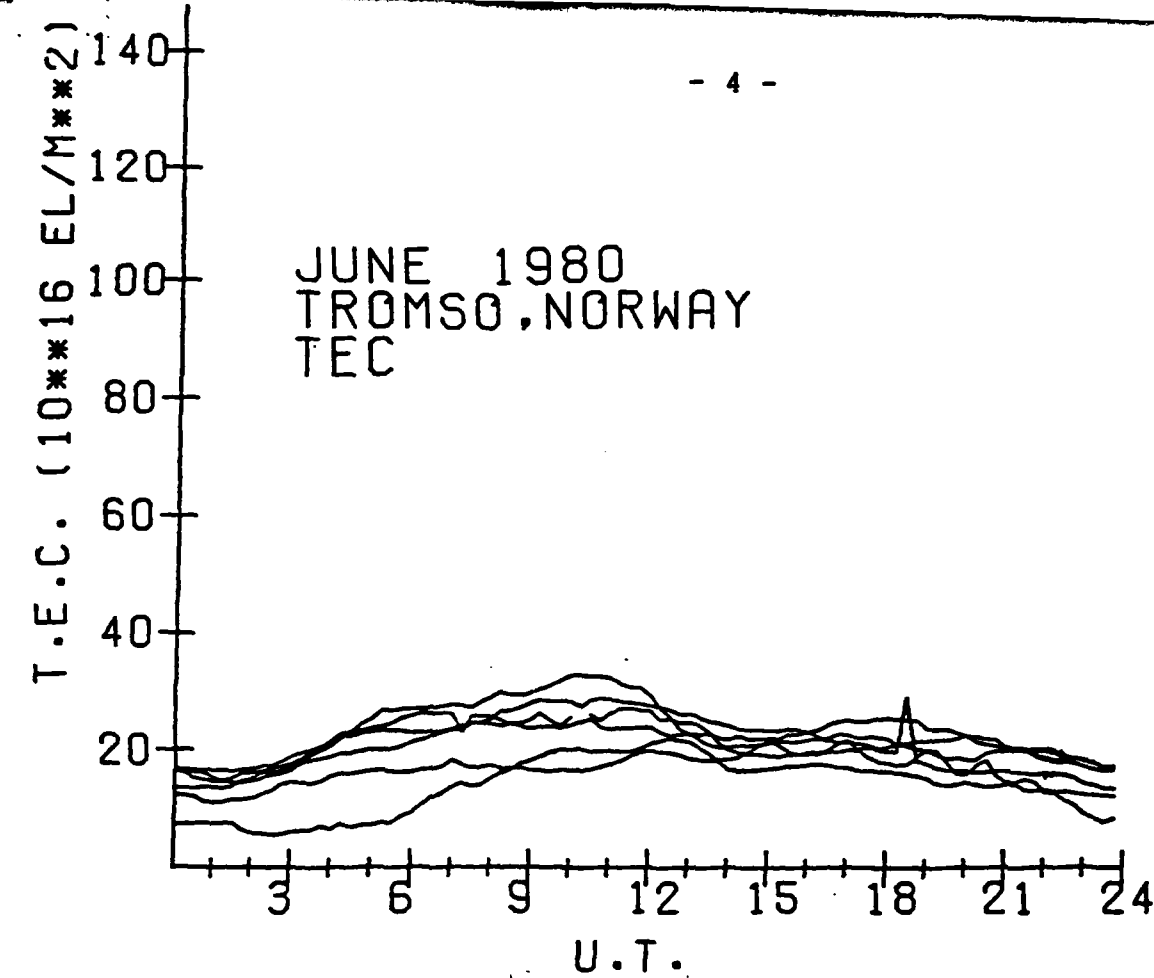


Fig. 1 VHF Faraday polarimeter overplots. (priv. comm. J. Klobuchar 1980).

1980 Date	UT (hr)	SV	DELAY (m)	
			GPS	POL
June	3	8	5.7	4.3
	4	5	5.5	3.8
	5	5	6.4	5.1
	6	8	5.5	4.1
	6	4	5.4	4.2
	6	5	5.4	4.0
	7	8	4.0	2.9
	8	4	5.4	3.1
	8	5	3.9	3.1
Aug	5	9	5.9	3.6
	6	4	3.2	2.4
	6	5	3.6	2.6
	7	4	3.2	2.2
	7	5	3.7	2.4
	7	9	4.6	2.6
	8	4	2.9	1.9
	8	5	3.3	2.1
	8	9	4.2	2.6
	11	4	4.0	2.5
	11	5	4.0	3.1
	11	9	5.0	4.2
	12	4	2.7	2.3
	12	5	3.6	2.7
	13	9	4.1	3.8

Table 1 Equivalent vertical delay from Navstar GPS and Faraday polarimeter measurements.

3 REFERENCES

- (1) Aksnes, K., Andersen, P.H. and Bredrup, E. (1981).
NATO Navstar GPS high latitude tests in Norway,
August 1979 to September 1980, FFI/RAPPORT-81/9001.
- (2) Klobuchar, J.A., Soicher, J. and Pearson, J.A. (1980).
A preliminary evaluation of the two-frequency
ionospheric correction for the Navstar-Global
Positioning system. AGARD CP 284, EEP Symp. in
London, 12-16 May 1980.